Cambridge Carbon Footprint

FLUKE®

TiR105 – CCF Thermal Camera
User Manual

Extracted from: Ti100, Ti105, Ti110, Ti125, TiR105, TiR110, TiR125 Users Manual Oct 2014

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Introduction

The **Fluke TiR105** Thermal Imager is a handheld, infrared imaging camera for use in many applications.
These applications include equipment troubleshooting, preventive and predictive maintenance, and building diagnostics. The **TiR105** is optimized for building inspection and diagnostics applications.

All Imagers display thermal images on a high-visibility LCD screen and can save images to an SD memory card. Saved images and data can be transferred to a PC via the SD memory card or by a direct USB connection to the PC.

The Imager includes SmartView® software. This software is a high-performance, professional software suite that allows for analysis and reporting.

Infrared images display in different color palettes on each Imager. The temperature measurement range is: -20 °C to +150 °C

A rugged, rechargeable lithium-ion smart battery provides power to the Imager. Direct AC power is accessible with the included AC power adapter.

The **TiR105** uses a focus-free system with a large depth of field that keeps the image in good focus at distances more than four feet.

Safety Information

To prevent eye damage and personal injury, do not look into the laser. Do not point laser directly at persons or animals or indirectly off reflective surfaces.
Additional laser warning information is on the inside of the Product lens cover.

Table 1 is a list of **symbols** used on the Imager and in this manual.

Symbol	Description	Symbol	Description
	Battery status. Battery charging when animated.		Connected to ac power. Battery removed.
	On/Off Symbol.		Sleep mode.
	Important information. See manual.		Warning. Laser.

How to Charge the Battery

1. Connect the ac power adapter into an ac wall outlet and connect the dc output to the Imager's ac power socket.
   
   flashes in the upper left- hand corner of the display while the battery charges with the ac power adapter.
2. Charge until the charge indicator on the display does not flash.
3. Disconnect ac power adapter when the smart battery is fully charged.

Note

Make sure that the Imager is near room temperature before you connect it to the charger. Charging temperature spec: 0 °C to 40 °C *When you charge in extreme temperatures, battery capacity may be decreased.*


shows in the upper left-hand corner of the display when the Imager is connected to ac power and the battery is removed. When the Imager's power is off and the ac power adapter is connected,

flashes in the center of the display to show that the battery charge is in process.

Keep the Imager attached to the charger until the battery condition icon shows a full charge. If you remove the Imager from the charger before a full charge shows, it may have a reduced run-time.

Note

When the battery is connected to ac power, the Sleep Mode/Auto Off feature is disabled automatically.

Power On and Off

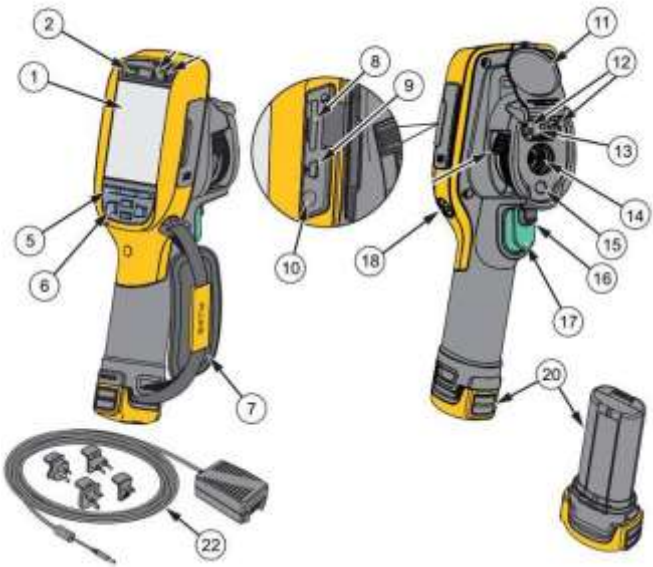
To turn the Imager on or off, push and hold the green  power button above the LCD for two seconds. When the Auto Off feature is on, the Imager goes into Sleep Mode after five minutes of inactivity and shows ……..  on the display. Press any key to restart the Imager.
After 20 minutes of inactivity, the Imager turns off.

Note

All thermal imagers need sufficient warm-up time for the most accurate temperature measurements and best image quality. This time can often vary by model and by environmental conditions. Although most imagers are fully warmed up in 3-5 minutes, it is always best to wait a minimum of 10 minutes if the most accurate temperature measurement is very important to your application. When you move an Imager between environments with large differences in ambient temperature, more adjustment time can be required.

Features and Controls

TiR105



1	LCD Display
2	**Power On/Off**
5	Function Buttons (F1, F2, F3)
6	Arrow Buttons
7	Hand Strap
8	**SD Memory Card Slot**
9	USB Cable Connection
10	**AC /Charge Input Terminal**
11	Retractable **Lens Cover**
12	Torch/Flashlight
13	Visual Camera and Lens
14	Infrared Camera Lens
15	Laser Pointer
16	**Secondary Trigger**
17	**Primary Trigger**
18	Hand Strap Anchor Posts
20	Lithium-ion Smart Battery
22	AC Adapter, Socket Adapters

Focus

The TiR105 uses a large depth of field focus-free system.

The focus-free system can focus at a minimum distance of 122 cm (48 in) Images closer than that will be blurred. Beyond that to infinity, hold the camera still and images should be sharp, with no adjustment.

Correct focus is important in all imaging applications. Correct focus makes sure that the infrared energy is correctly directed onto the pixels of the detector. Without the correct focus, the thermal image can be blurry and the radiometric data will be inaccurate. Out-of-focus infrared images are frequently unusable or of little value.

Primary and Secondary Triggers

The two-part trigger is located in the standard trigger position for a pistol-grip device. The larger, green trigger is the primary trigger. The smaller, black trigger is the secondary trigger.
The secondary trigger operates the laser and torch.

How to Use the Control Buttons

The function of the primary trigger is to capture a thermal image for possible storage to memory by the user.

Three function buttons ([F1], [F2], [F3]) and four arrow buttons ([◀], [▶], [▲], and [▼]) are the primary controls. These buttons move the cursor through the menu structure to set the features.

Table 5 is an overview of the buttons and their actions. In live Manual Mode, the arrow buttons are always active to adjust Level and Span.

Table 5. Overview of Controls

Button	Button Label / Action
[F3], Trigger	Cancel
[F1], Trigger	Done (exit from Menu structure)
[F1], [▶]	Select or OK
[F2], [◀]	Back
[▲], [▼]	Move cursor to highlight an option

How to Use the Menus

The menus, coupled with the three function buttons ([F1], [F2], [F3]) and arrow buttons, are the access for thermal image display, camera features, memory review, and settings for date, time, language, units, file format, and Imager information.

To open the primary menu, push [F2] or [▶]. The primary menu shows five secondary menus for Measurement, Image, Camera, Memory, and Settings. The text above each function button ([F1], [F2], [F3]) applies to that button throughout all menu screens.

Push [F2] to open the primary menu and push [▲]/[▼] to cycle through the secondary menus. Each secondary menu lists an options menu. Push [▲]/[▼] to cycle through the options.

The primary, secondary, and option menus close 10 seconds after the last push of a function button. The option selection menu stays open until you make the selection, go up a menu level, or cancel the action.

Image Capture

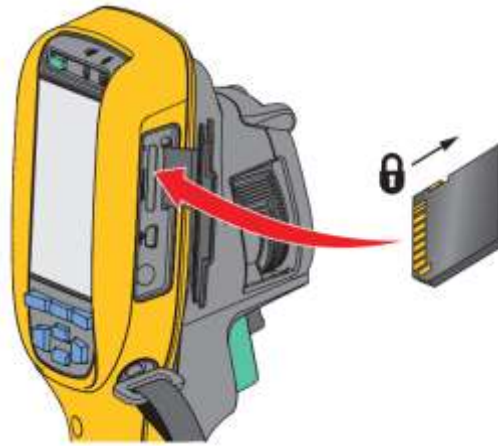
Point the imager at the object or area of interest. Make sure that the object is in focus. Pull and release the primary trigger. This will capture and freeze the image. **Save it by pressing F1. ←NB!**

To cancel the captured image, pull the primary trigger again or [F3] to return to the Live view.

SD Memory Card

To eject an SD memory card, push in on the exposed edge of the card and then release. The card should pop partially out after you release it. Carefully pull
the card out of the slot.

To use the SD memory card, make sure that the write-protect lock is open. See Figure 3. Carefully push the card into the slot with the card label facing away the LCD. Push the card in until it catches.



Menus

The menus, together with the three function buttons (F1, F2, F3) and arrow buttons, are access for thermal image display, camera features, memory setup, and settings for date, time, language, units, file format, and Imager information.

Measurement Menu

The Measurement Menu has settings for the calculation and display of radiometric temperature measurement data related to the thermal images. These settings include the Range (Auto and Manual Level and Span adjustment), Emissivity, Background, Transmission, Spot Temperatures, Markers, and Center Box.

Range

Range (level and span) is set to automatically adjust or is set for manual adjustment. To choose between automatic or manual level and span, do the following:

1. Push F2.
2. Push ▲/▼ to highlight **Measurement**.
3. Push F1 or ▷ to view the menu.
4. Push ▲/▼ to highlight **Range**.
5. Push F1 or ▷ to view the menu.
6. Push ▲/▼ to toggle between the Auto and Manual ranging.
7. Push F1 to set.
8. Push:
   - F1 to set the change and go back to the live view.
   - F2 or ◁ to set the change and go back to the previous menu.
   - F3 to cancel the change and go back to the live view.

Fast Auto/Manual Range Toggle

When NOT in a menu mode, push [F1] for ½ second to toggle between Auto Range and Manual Range.

Fast Auto Rescale

When in Manual Range and NOT in a menu mode, push [F3] for ½ second to automatically rescale the level and span range for objects in the thermal field of view. This feature operates the Imager in a semi-automatic mode if manual fine re-adjustment of level and span with the arrow buttons is not necessary. Rescaling can be done as often, or as little, as needed.

Note

The Imager always powers up in the same Range mode, Auto or Manual, as when it was powered down.

Level for Manual Operation Mode

When put into manual ranging, the level setting moves the thermal span up or down within the total temperature range. See Figure 4. In the live manual mode, the arrow buttons are always available to adjust the level and span.

To set the level:

1. Push [▲] to move the range to a higher temperature level.
2. Push [▼] to move the range to a lower temperature level.

While you adjust the manual level, the scale along the right side of the display shows the thermal span as it moves to different levels within the total range.

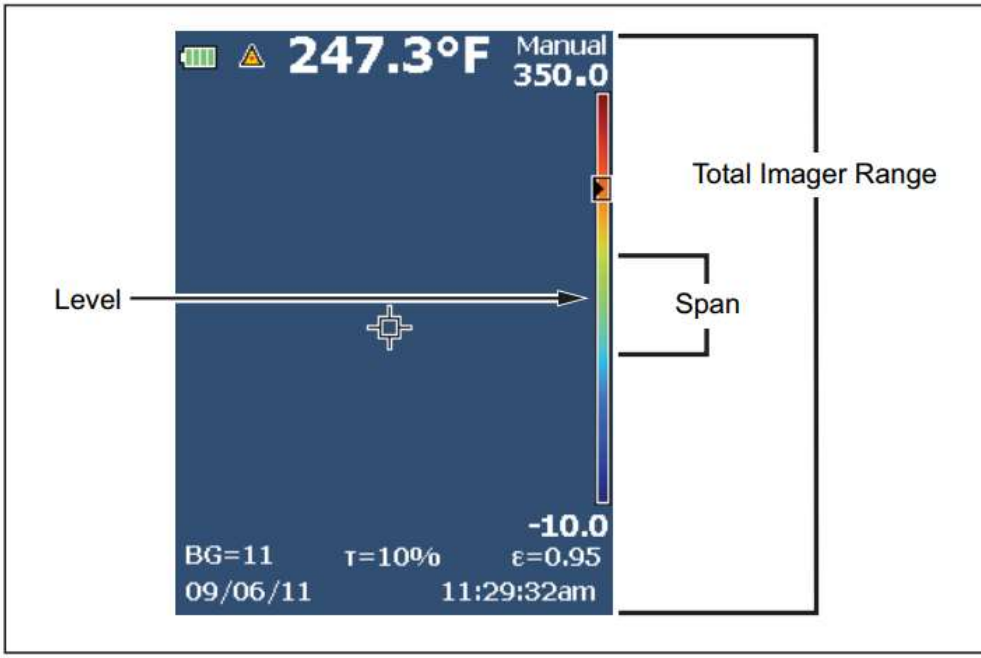


Figure 4. Level and Span Settings

Temperature Span for Manual Operation Mode

When in manual mode, the span setting contracts or expands in a selected palette in a temperature range within the total range. See Figure 4. In the live manual mode, the arrow buttons are always available to adjust the level and span.

To adjust the temperature span:

1. Push ▷▶ to increase or widen the temperature span.
2. Push ◀◁ to decrease or narrow the temperature span.

While you adjust the manual span, the scale along the right side of the display shows the thermal span increasing or decreasing in size.

Image Menu

The Image menu has controls for different features used in the presentation of the infrared image on the Imager's LCD and some saved image files.

Data saved as .is2 format can easily be modified within SmartView software. .bmp or .jpg format will retain image settings at the time of capture and save.

Palette

The Palette menu lets you change the false-color presentation of the infrared images on display or capture.

To set a palette:

1. Push [F2].
2. Push [▲]/[▼] to highlight **Measurement**.
3. Push [F1] or [▶▶] to view the menu.
4. Push [▲]/[▼] to highlight **Image**.
5. Push [F1] or [▶▶] to view the menu.
6. Push [▲]/[▼] to highlight **Palette**.

IR-Fusion®

IR-Fusion® makes it easier to understand infrared images through the use of an aligned visible image and infrared image.

To set the IR-Fusion mode:

1. Push [F2].
2. Push [▲]/[▼] to highlight **Measurement**.
3. Push [F1] or [▶▶] to view the menu.
4. Push [▲]/[▼] to highlight **Image**.
5. Push [F1] or [▶▶] to view the menu.
6. Push [▲]/[▼] to highlight **IR-Fusion**.
7. Push [F1] or [▶▶] to view the menu.
8. Push [▲]/[▼] to highlight an option.
9. Push:
   - [F1] to set the change and go back to the live view.
   - [F2] or [◀◀] to set the change and go back to the previous menu.
   - [F3] to cancel the change and go back to the live view.

Settings Menu

The Settings menu has adjustments for user preferences such as units of temperature measurement, file format of stored data, auto off settings, date, time, and language. This menu also has a section that displays information about the Imager such as model number, serial number, and firmware versions.

Units

To change the temperature units:

1. Push F2.
2. Push ▲/▼ to highlight **Settings**.
3. Push F1 or ▷ to view the menu.
4. Push ▲/▼ to highlight **Units**.
5. Push F1 or ▷ to view the menu.
6. Push ▲/▼ to highlight an option.
7. Push:
   - F1 to set the change and go back to the live view.
   - F2 or ◁ to set the change and go back to the previous menu.
   - F3 to cancel the change and go back to the live view.

File Format

Data can be saved to the SD memory card in different file formats. Image format selections are .bmp, .jpg, and .is2 These selections remain valid when you turn the Imager off or on. To change the file format:

1. Push F2.
2. Push ▲/▼ to highlight **Settings**.
3. Push F1 or ▷ to view the menu.
4. Push ▲/▼ to highlight **File Format**.
5. Push F1 or ▷ to view the menu.
6. Push ▲/▼ to highlight an option.
7. Push F1 to set the option.
8. Push:
   - F1 to set the change and go back to the live view.
   - F2 or ◁ to set the change and go back to the previous menu.
   - F3 to cancel the change and go back to the live view.

Images saved in the .is2 file format have the consolidation of all data into a single file and are more flexible for analysis and modification in the included SmartView software. This file format consolidates the infrared image, radiometric temperature data & visible image into one location.

For situations where a smaller file size with maximum resolution is needed and modification is not, choose the .bmp file format. For the smallest file size where modification is not needed and image quality and resolution are not as important, choose the .jpg file format.

The .bmp and .jpg files can be emailed and then opened on most PC and MAC systems without special software. These formats do not allow full analysis capabilities or modification.

The .is2 file format can be emailed and then opened with SmartView Software. This format has the maximum versatility.
Visit the Fluke website to download SmartView software at no charge.

Auto Off

Auto Off is set as off or on. When set to on, the Imager goes into the Sleep mode after 5 minutes of inactivity. After 20 minutes of inactivity the Imager turns off

Note

When the battery is connected to AC Power, or the unit is in video mode, the Sleep Mode/Auto Off feature is automatically disabled.

To set or disable the Auto Off feature:

1. Push F2.
2. Push ▲/▼ to highlight **Settings**.
3. Push F1 or ▷▶ to view the menu.
4. Push ▲/▼ to highlight **Auto Off**.
5. Push F1 or ▷▶ to view the menu.
6. Push ▲/▼ to highlight an option.
7. Push F1 to set the option.
8. Push:
   - F1 to go back to the live view.
   - F2 or ◀◁ to set the change and go back to the previous menu.
   - F3 to cancel the change and go back to the live view.

Memory Menu

The Memory Menu allows the user to review captured images as thumbnails.

Review Data Files

To view stored images on the SD memory card:

1. Push F2.
2. Push ▲/▼ to highlight **Memory**.
3. Push F1 or ▷ to view the memory menu.
4. Push ▲ ▼ ◁ ▷ to highlight the thumbnail of the file for review.
5. Push F1 to review the file.

Delete Data Files

To erase one image from the SD memory card:

1. Push F2.
2. Push ▲/▼ to highlight **Memory**.
3. Push F1 or ▷ to view the memory menu.
4. Push ▲ ▼ ◁ ▷ to highlight the thumbnail of the file to delete.
5. Highlight **Selected Image** and push ▷. The Imager prompts you to continue or cancel.
6. Push F1 to delete the file.

To erase all the images from the SD memory card:

1. Push F2.
2. Push ▲/▼ to highlight **Memory**.
3. Push F2.
4. Highlight **All Image** and push ▷. The Imager prompts you to continue or cancel.
5. Push F1 to delete all files on the SD memory card.

The Following sections are quite SPECIALIST:

In Building surveys we're mainly interested in temperature differences, rather than accurate temperature measurements.

Temperature Measurement

All objects radiate infrared energy. The quantity of energy radiated is based on the actual surface temperature and the surface emissivity of the object. The Imager senses the infrared energy from the surface of the object and uses this data to calculate an estimated temperature value. Many common objects and materials such as painted metal, wood, water, skin, and cloth are very good at radiating energy and it is easy to get relatively accurate measurements. For surfaces that are good at radiating energy (high emissivity), the emissivity factor is ≥90 % (or 0.90). This simplification does not work on shiny surfaces or unpainted metals as they have an emissivity of <0.60. These materials are not good at radiating energy and are classified as low emissivity. To more accurately measure materials with a low emissivity, an emissivity correction is necessary. Adjustment to the emissivity setting will usually allow the Imager to calculate a more accurate estimate of the actual temperature.

> ***Note***
>
> Surfaces with an emissivity <0.60 make reliable and consistent determination of actual temperatures problematic. The lower the emissivity, the more potential error is associated with the Imager's temperature measurement calculations, even when emissivity and reflected background adjustments are attempted and performed properly.

More information is available on emissivity. We recommend the study of this topic to get the most accurate temperature measurements.

SmartView® Software

SmartView® software is supplied with the Imager. This software is intended for Fluke Imagers and contains features to analyze images, organize data and information, and make professional reports. SmartView® is used to export IR and visible images as .jpeg, .jpg, .jpe, .jfif, .bmp, .gif, .dip, .png, .tif, or .tiff formatted files.

Images can be rotated in SmartView.

Emissivity Adjustment

The correct emissivity values are important for you to make the most accurate temperature measurements. Emissivity of a surface can have a large effect on the apparent temperatures that the Imager observes. Understanding the emissivity of the surface being inspected can, but may not always, allow you to obtain more accurate temperature measurements.

Adjust by Number

To set the emissivity value:

1. Push F2.
2. Push ▲/▼ to highlight **Measurement**.
3. Push F1 or ▷▶ to view the menu.
4. Push ▲/▼ to highlight **Emissivity**.
5. Push F1 or ▷▶ to view the menu.
6. Push ▲/▼ to highlight **Adjust Number**.
7. Push F1 or ▷▶ to view the menu.
8. Push ▲/▼ to change the value.
9. Push:
   - F1 to set the change and go back to the live view.
   - F2 or ◀◁ to set the change and go back to the previous menu.
   - F3 to cancel the change and go back to the live view.

Select by Table

To select from a list of common materials:

1. Push F2.
2. Push ▲/▼ to highlight **Measurement**.
3. Push F1 or ▷▶ to view the menu.
4. Push ▲/▼ to highlight **Emissivity**.
5. Push F1 or ▷▶ to view the menu.
6. Push ▲/▼ to highlight **Select Table**.
7. Push F1 or ▷▶ to view the emissivity table.
8. Push ▲/▼ to change the value.
9. Push:
   - F1 to set the change and go back to the live view.
   - F2 or ◀◁ to set the change and go back to the previous menu.
   - F3 to cancel the change and go back to the live view.

Reflected Background Temperature Compensation

Compensation for reflected background temperature is set in the Background tab. Very hot objects or very cold objects can affect the apparent temperature and measurement accuracy of the target or object of interest, especially when surface emissivity is low. Adjustment of the reflected background temperature can make the temperature measurement better in many situations. For more information, see *Emissivity Adjustment*.

1. Push F2.
2. Push ▲/▼ to highlight **Measurement**.
3. Push F1 or ▷▶ to view the menu.
4. Push ▲/▼ to highlight **Background**.
5. Push F1 or ▷▶ to view the menu.
6. Push ▲/▼ to change the value.
7. Push:
   - F1 to set the change and go back to the live view.
   - F2 or ◀◁ to set the change and go back to the previous menu.
   - F3 to cancel the change and go back to the live view.

Transmission/Transmittance Adjustment

When you do infrared inspections through infrared-transparent windows (IR windows), not all of the infrared energy emitted from the objects of interest is transmitted through the optical material in the window. If the transmission percentage of the window is known, you can adjust this percentage in the Imager or in the SmartView software. Adjustment of the transmission correction can make the accuracy of the temperature measurement better in many situations.

To adjust the transmission percentage:

1. Push F2.
2. Push ▲/▼ to highlight **Measurement**.
3. Push F1 or ▷▶ to view the menu.
4. Push ▲/▼ to highlight **Transmission**.
5. Push F1 or ▷▶ to view the menu.
6. Push ▲/▼ to adjust the percentage.
7. Push:
   - F1 to set the change and go back to the live view.
   - F2 or ◀◁ to set the change and go back to the previous menu.
   - F3 to cancel the change and go back to the live view.

Laser Pointer

The laser pointer is a sighting aid and is offset from the infrared camera. As a result, it may not always represent the exact center of the infrared or visible image. ***no Laser on TiR***

The laser dot does not appear on an infrared-only image, but does on visible-only or AutoBlend images. The laser dot cannot be seen in the visible channel of the IR-Fusion image if obscured by the center point marker graphic.

The laser pointer selections are Trigger Laser, Trigger Torch, and Laser/Torch. When set, pull the secondary trigger to turn on, release the secondary trigger to turn off.

Warning

To prevent eye damage and personal injury, do not look into the laser. Do not point laser directly at persons or animals or indirectly off reflective surfaces.

To set:

1. Push F2.
2. Push ▲/▼ to highlight **Camera**.
3. Push F1 or ▷ to view the menu.
4. Push ▲/▼ to highlight **Laser/Torch**.
5. Push F1 or ▷ to view the menu.
6. Push ▲/▼ to highlight an option.
7. Push F1 to set the option.
8. Push:
   - F1 to set the change and go back to the live view.
   - F2 or ◁ to set the change and go back to the previous menu.
   - F3 to cancel the change and go back to the live view.

The laser warning symbol (⚠) shows in the Header zone of the display when the laser is turned on and you pull the secondary trigger.

Torch

The torch illuminates darker work areas. When set, pull the secondary trigger to operate.

Note

When the torch is on and an image is captured, the torch momentarily shines brighter and functions as a visible camera flash.

To set:

1. Push F2.
2. Push ▲/▼ to highlight **Camera**.
3. Push F1 or ▶ to view the menu.
4. Push ▲/▼ to highlight **Laser/Torch**.
5. Push F1 or ▶ to view the menu.
6. Push ▲/▼ to highlight an option.
7. Push F1 to set the option.
8. Push:
   - F1 to set the change and go back to the live view.
   - F2 or ◀ to set the change and go back to the previous menu.
   - F3 to cancel the change and go back to the live view.

Backlight

The backlight level control is set to low, medium, and high. To set the backlight:

1. Push F2.
2. Push ▲/▼ to highlight **Camera**.
3. Push F1 or ▶ to view the menu.
4. Push ▲/▼ to highlight **Backlight**.
5. Push F1 or ▶ to view the menu.
6. Push ▲/▼ to highlight an option.
7. Push:
   - F1 to set the change and go back to the live view.
   - F2 or ◀ to set the change and go back to the previous menu.
   - F3 to cancel the change and go back to the live view.

Maintenance

How to Clean the Case

Clean the case with a damp cloth and a weak soap solution. Do not use abrasives, isopropyl alcohol, or solvents to clean the case or lens/window.

Battery Care

Warning

To prevent personal injury and for safe operation of the Product:

- **Do not put battery cells and battery packs near heat or fire. Do not put in sunlight.**
- **Do not disassemble or crush battery cells and battery packs.**
- **Remove batteries to prevent battery leakage and damage to the Product if it is not used for an extended period.**
- **Connect the battery charger to the mains power outlet before the charger.**
- **Use only Fluke approved power adapters to charge the battery.**
- **Keep cells and battery packs clean and dry. Clean dirty connectors with a dry, clean cloth.**

To get the best performance from the battery, use the guidelines that follow:

- Do not store the Imager on the charger for more than 24 hours as reduced battery life may result.
- Charge the Imager for a two-hour minimum at six-month intervals for maximum battery life. Without use, the battery will self-discharge in approximately six months. Batteries stored for long periods will need two to ten charging cycles for full capacity.
- Always operate in the specified temperature range.

Specifications

Temperature

Operating .....-10 °C to 50 °C (14 °F to 122 °F)

Charging..... .0 °C to 40 °C (32 °F to 104 °F)

Relative Humidity .....10 to 95 % non-condensing

Power

Battery ..... Lithium-ion rechargeable smart battery

Battery Life..... 4+ hours (50 % LCD brightness)

Battery Charge Time..... 2.5 hours to full charge

Power Saving..... Sleep Mode activated after 5 minutes of inactivity

Automatic Power Off after 20 minutes of inactivity

Drop .....2 meter

Weight.....726g (1.6 lb)

Enclosure Rating IP54

Warranty.....2 years

Calibration Cycle .....2 years (assumes normal operation and normal aging)

Temperature Measurements

Temperature Range -20 °C to +150 °C

Accuracy.....±2 °C or 2 % (whichever is greater) at 25 °C

Imaging Performance

Field of View.....31 ° x 22.5 °

For a broad scene hold imager on its side & rotate image in SmartView

Spatial Resolution (IFOV).....3.39 mRad

Minimum Focus Distance 122 cm (4 ft) Focus-free

Image Capture or Refresh Rate..... 9 Hz

Detector Type ..... 160 X 120 Focal Plane array, uncooled microbolometer

Thermal Sensitivity (NETD) ≤80 mK (0.08 °C at 30 °C target temp)

Minimum Span (in manual mode)..... 2.0 °C, 2.5 °C (auto mode)

File Formats ..... Non-Radiometric (.bmp, .jpg) or Fully-Radiometric (.is2)

No analysis software required for Non-Radiometric (.bmp, .jpg) files